SUPPORTING DOCUMENT G

Upper Swift Creek Watershed - Riparian Buffer Analysis

The Upper Swift Creek Watershed, which is approximately 34,560 acres, contains 100 miles of perennial streams as determined by field verification. The one hundred foot resource protection area (RPA), which is protected by the Chesapeake Bay Act, contains approximately 2450 acres. This 100-foot riparian buffer was analyzed in GIS by overlaying the buffer with 2002 aerial photography. Several land cover categories were determined. The categories are: forested, grass/scrub, residential, wetland/marsh, impervious/paved, or golf course. The following figure depicts a percentage breakdown of land within the buffer.

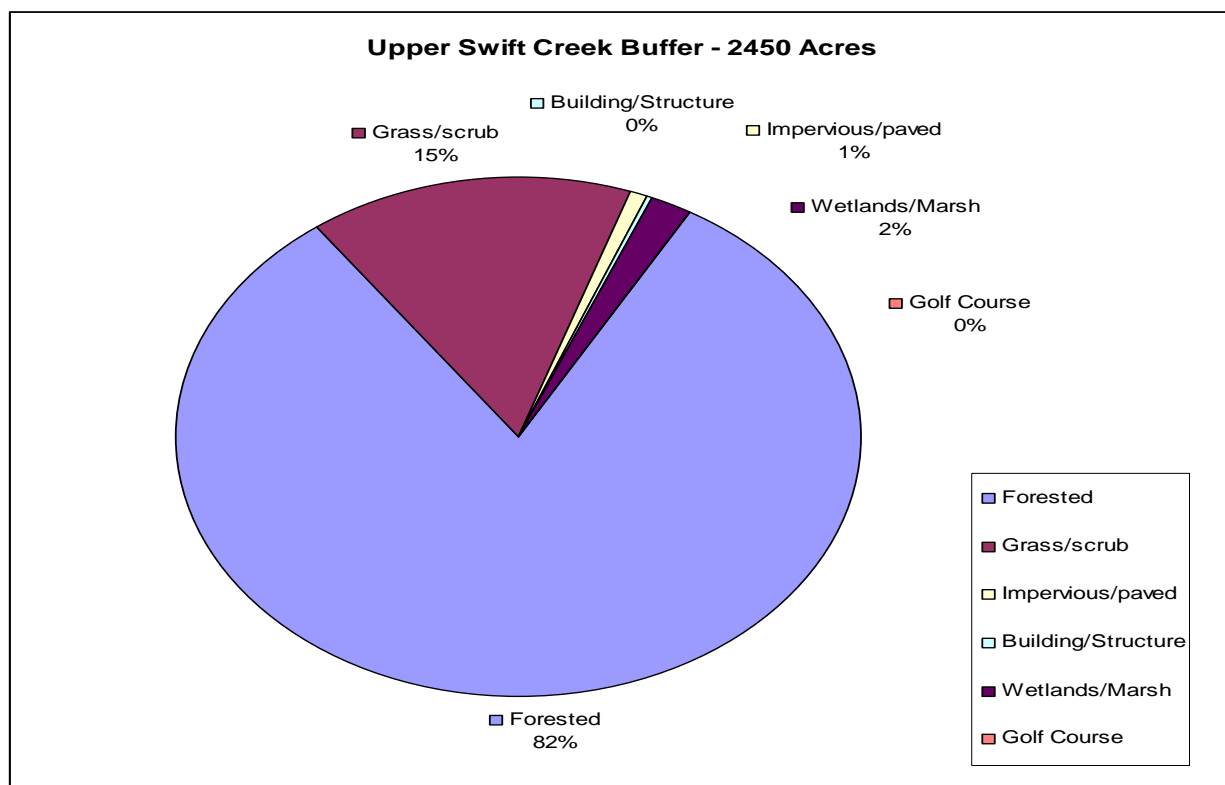*Figure 1.Percentage of land cover categories within riparian buffer*

Figure 2. Land cover categories in acres

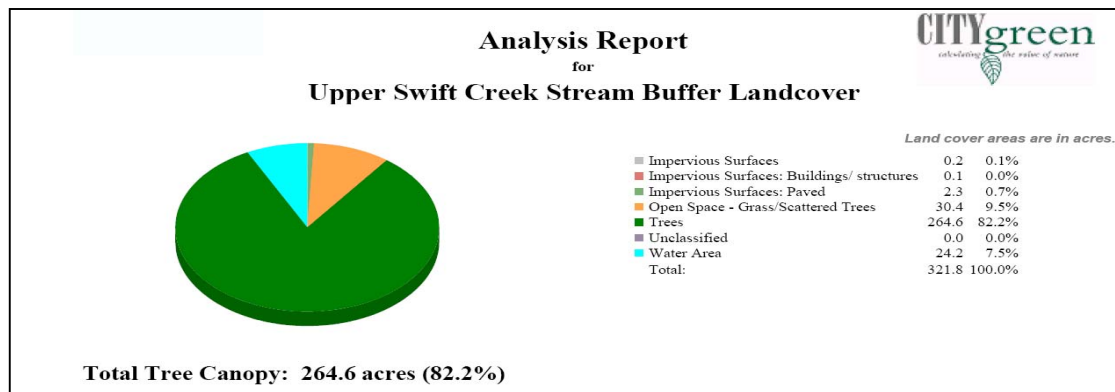| Category	Acreage
Forested	1994
Grass/scrub	377
Paved surfaces	19
Buildings	8.5
Wetlands/marsh	43
Golf course	3
Total	2450

Sub-watershed Analysis:

Ecosystem services can be calculated based on land cover area provided by the forested area using CITYgreen analysis software. We have not analyzed the entire Upper Swift Creek Watershed but we have assessed the Swift Creek (Figure 3) sub watershed, which is approximately 5427 acres. The results are impressive.

Figure 3. Swift Creek Region

Upper Swift Creek Sub-Watershed
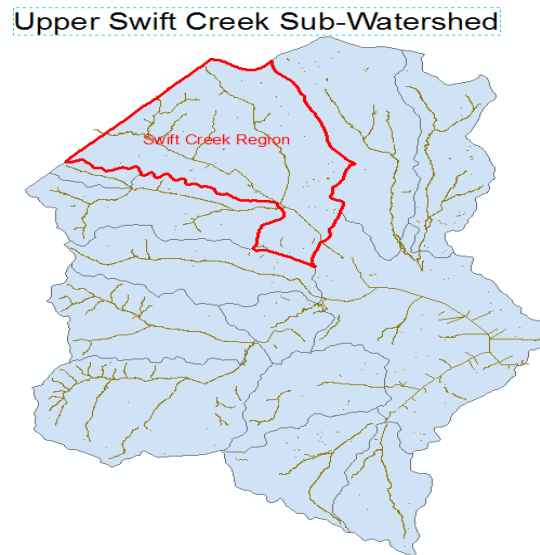
Swift Creek Region

The CITYgreen report shows a significant economical and ecological resource provided by the trees in the riparian buffer for the Swift Creek region. Sections of the report are included in figures 4 – 6.

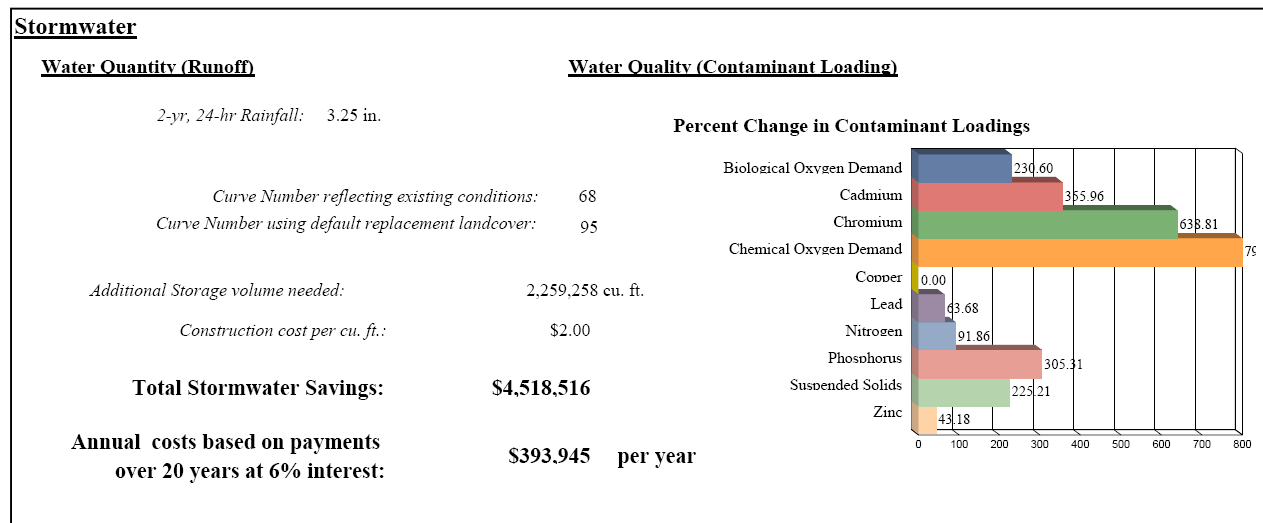*Figure 4. – The report shows the percentage land cover in the riparian buffers for the Swift Creek region.*

Analysis Report
for
Upper Swift Creek Stream Buffer Landcover

CITYgreen
calculating the value of nature

Land cover areas are in acres.

Impervious Surfaces	0.2	0.1%
Impervious Surfaces: Buildings/ structures	0.1	0.0%
Impervious Surfaces: Paved	2.3	0.7%
Open Space - Grass/Scattered Trees	30.4	9.5%
Trees	264.6	82.2%
Unclassified	0.0	0.0%
Water Area	24.2	7.5%
Total:	321.8	100.0%

Total Tree Canopy: 264.6 acres (82.2%)

Figure 5. – The report shows the air pollution removal in pounds and value of the pollution removal by trees in the buffer.

Air Pollution Removal

Nearest Air Quality Reference City: **Washington DC**

	Lbs. Removed/yr	Dollar Value
Carbon Monoxide:	1,179	$503
Ozone:	9,198	$28,260
Nitrogen Dioxide:	4,717	$14,492
Particulate Matter:	7,783	$15,965
Sulfur Dioxide:	3,774	$2,832
Totals:	**26,652**	**$62,052**

Carbon Storage and Sequestration

Total Tons Stored:	**11,385.71**
Total Tons Sequestered (Annually):	**88.64**

Figure 6. – The report shows the positive affect of the trees in the riparian buffer on water quality. The figures are based on the land without tree coverage. For example, with no trees in the buffer the total stormwater savings would be zero dollars. But with 82% tree coverage in the buffer the county saves more than 4.5 million dollars based on storm water maintenance costs.

Stormwater

Water Quantity (Runoff)

2-yr, 24-hr Rainfall:	3.25 in.
Curve Number reflecting existing conditions:	68
Curve Number using default replacement landcover:	95
Additional Storage volume needed:	2,259,258 cu. ft.
Construction cost per cu. ft.:	$2.00
Total Stormwater Savings:	**$4,518,516**
Annual costs based on payments over 20 years at 6% interest:	**$393.945** per year

Water Quality (Contaminant Loading)

Percent Change in Contaminant Loadings

Contaminant	Percent Change
Biological Oxygen Demand	230.60
Cadmium	355.96
Chromium	638.81
Chemical Oxygen Demand	79
Copper	0.00
Lead	63.68
Nitrogen	91.86
Phosphorus	305.31
Suspended Solids	225.21
Zinc	43.18

It is important to keep in mind that the report above only analyzes 321 acres of riparian buffers which accounts for only six percent of land cover in the Swift Creek sub-watershed of the Upper Swift Creek Watershed. Even with the small amount of coverage this report shows the potential savings, both economically and ecologically, are enormous.

Land Cover Change Analysis:

CITYgreen also allows users to analyze potential future changes in land cover. The user can specify land coverage percentages and the program will report changes in water and air quality as well as economic values. For example, the county may be considering new developments or agriculture expansion in the Upper Swift Creek area that affect land cover. The program then allows us to determine the impacts of the development by changing the percentage of land cover. Therefore, based upon the prior percentages in *figure 4*, we shifted the land cover percentages to make crop lands account for 26%, decreased the tree cover to 33%, and increased open space or grass cover to 30% to create a hypothetical situation if development occurred. In turn, the land cover changes allow us to see the impact on water and air quality. The results were impressive. With the decrease in tree cover from 82% to 33%, the stormwater savings decreased from $4.5 million in *figure 2* to $2 million (see figure 7).

Figure 7. – Stormwater Example – The report shows the significant loss of water quality due to a decrease in tree cover.
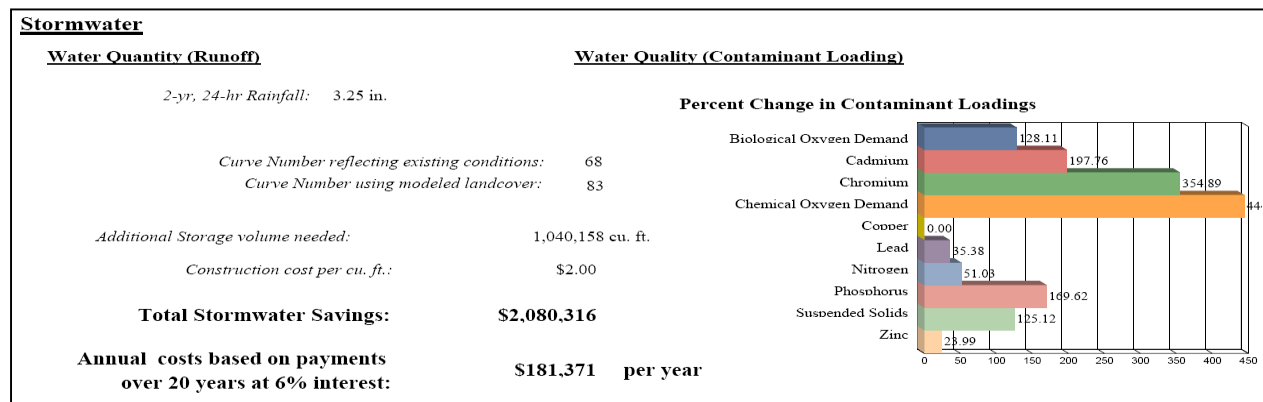

Figure 8. – Analysis shows a significant loss of air pollution removal.

Although these numbers are remarkable they do not tell the whole story. The CITYgreen program that creates these reports is formatted for general land covers, not riparian areas.

Therefore, it likely that riparian land covers have a more drastic impact on water quality than the CITYgreen software indicates. Besides pollution removal riparian forests also serve to maintain stream temperatures through shading, stabilize the stream banks, and provide erosion control. In addition, CITYgreen does not calculate the economic impact of cleaner water on recreation, the fishing industry or drinking water filtration. Simply put, the numbers generated by CITYgreen are likely on the low end in terms of ecological services and the dollar value of the services.